A discharging container with a filter

FIELD OF THE INVENTION

The present invention relates to a discharging container with a filter, which is suitable for use as an aseptic eyedropper.

BACKGROUND ART

Regarding this kind of aseptic eyedropper, applicants of the present invention had already proposed what is disclosed in the following patent document 1.

Patent document 1: The Japanese Patent Laying-Open Gazette No. 2001-114328.

This prior aseptic eyedropper has a bottle which contains a squeezable outer layer with a laminated inner layer peelable from the outer layer, and a plug body mounted onto the opening of the bottle. The plug body has a discharging channel to discharge the liquid kept in a body portion of the inner layer. There is a distribution valve and a filter in the discharging channel, and this distribution valve consists of a flange, a valve head, and a connector sleeve, and is integrally molded from elastic materials such as silicon rubber. The valve head has an orifice incised in a crisscross manner on its center position; the connector sleeve has a flexible structure, which has a relatively thin wall which can be easily deformed. Consequently, when the outer layer is deformed by squeezing and the pressure in the body portion of the inner layer increases, the distribution valve is elastically deformed so as to displace the valve head downstream and open the orifice at the same time, so that the liquid flows down from the filter to the downstream side and the content is dribbled. Also, when the pressure in the body portion of the inner layer is eliminated, the distribution valve is re-deformed so that the liquid staying in the discharging

channel is sucked back to the upperstream of the filter by displacing the valve head to the upperstream with the orifice closed. This prevents the possibility of the liquid in the body portion being outerly contaminated.

Meanwhile, in the aforementioned prior aseptic eyedropper, there is some amount of air from shipment, and this air will not flow from the distribution valve to the downstream side of discharging when the eyedropper is used in an ordinary manner. However, if the body of the bottle is squeezed with the nozzle turned upward, the air in the inner layer would flow, pushing up the distribution valve and going in the space between the dividing vale and the filter. With that, especially using a hydrophilic filter, the air between the distribution valve and the filter is in the state where it is sealed between them, the so-called "airlock" because the air cannot go through the filter. There is the problem that it is practically impossible to drop the liquid, since it becomes more necessary to affect the higher pressure than the bubble point of the filter in the body of the inner layer.

Also, because the distribution valve, which has the abovementioned particular shape, is used, there is the problem that the cost overrun of the container is incurred.

SUMMARY OF THE INVENTION

Consequently, the object of the present invention is to provide a discharging container with a filter, which is able to drop the content with precision by sucking back the liquid staying in the downstream of the filter to the upperstream of the filter without so-called "airlock", moreover, to enable cost reduction.

In order to achieve the aforementioned object, the present inventors have employed a technological feature as summarized below.

In other words, the present invention is a discharging container with a filter comprising a bottle which is formed in a manner wherein an inner layer, peelable from an outer layer, is formed on an inner surface of the outer layer, a plug body placed on a mouth portion of the bottle, and a filter provided in a discharging pass which is provided in the plug body for discharging liquid kept in a body of the inner layer provided, wherein said inner layer has a memory which expands the inner layer in a manner wherein the difference between an inner negative pressure and the ambient air is higher than the filtration resistance of the filter, and wherein the negative pressure is caused by the memory of the inner layer and by that liquid remained in a second side of the filter is sucked into a primary side of the filter.

According to the present invention, by pushing the body of the bottle, the inner layer is deformed, so that the liquid inside is dropped from the body through the discharging pass. Also, by stopping pushing the body of the bottle, the negative pressure is caused by the memory of the inner layer and by that, liquid remained in the second side (lower stream of discharging) of the filter is sucked into the primary side (upper stream of discharging) of the filter. Particularly, compared with the prior arts, it is possible to achieve a cost reduction since the aforementioned function can be achieved without using the distribution valve in a specialized shape.

The discharging container with a filter of the present invention is preferably formed wherein said filter has hydrophilicity. By that, the liquid inside is filled in the filter, so that it is possible to prevent the ambient air from entering the upper stream side of the filter without fail. Also, the elastic memory of the inner layer is preferably formed in a manner wherein the difference between the inner pressure of the inner layer and the ambient air is lower than the resistance, in which the air is able to pass through the filter filled with the liquid in-

side. That can prevent the air from entering in to the upper stream of the filter more surely.

Also, in the present invention, it is preferable that the body of the inner layer is made from synthetic resin, the average thickness of the body is over 0.1mm, more preferably, over 0.35mm, and the average thickness of the body is less than 0.5mm, more preferably, less than 0.4mm. By that, the inner layer can be formed to have a desired elastic-memory.

Additionally, in the present invention, it is preferable to adopt the composition in which the outer layer has an entry opening to bring the outside air in between the outer layer and the inner layer. By that, when pushing of the bottle is released, the ambient air flows in through the entry opening and the pressure between the outer layer and the inner layer becomes the ambient pressure, so that the difference of the pressure between the upper stream of the filter and the lower stream of the filter caused by the elastic-memory of the inner layer can be in the desired range without fail. It is possible to provide the distribution valve for the entry opening, but it is also possible to form the entry opening with an opening which is closed when the body of the bottle is pushed.

Also, in the present invention, it is possible to form the bottle, a so-called monolayer bottle, which does not have an outer layer.

In the present invention, it is possible to provide a discharging container with a filter, which is able to drop the content with precision by sucking back the liquid staying in the downstream of the filter to the upperstream of the filter without so-called "airlock", moreover, to enable cost reduction. Likewise, in eyedroppers of the prior arts, when the container refrigerated is taken out from the chillroom to the outside, the inside temperature of the container will be higher because of the room temperature, the air in the container will expand, and the liquid inside will ooze out. However, in the present invention, there is

no liquid reserved under the filter, so that the aforementioned oozing will not occur.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 Scale-up longitudinal sectional view of the relevant part of the eyedropper with a laminated film-peeling bottle of an embodiment of the present invention;

Fig. 2 Whole longitudinal sectional view of said eyedropper;

Fig. 3 (a) is a plane view and (b) is an elevated view, both show the whole picture of the laminated film-peeling bottle of said eyedropper;

Fig. 4 Lateral view of said laminating film-peeling bottle;

Fig. 5 Cross sectional view taken along the plane A-A of Fig.3.

THE PREFERRED EMBODIMENTS

With reference to the attached drawings, the present invention will hereinafter be described by way of an embodiment thereof.

Figs. 1 and 2 illustrate an eyedropper as a laminated bottle with an outer layer and an inner layer according to an embodiment of the present invention. This eyedropper 10 has a laminated film-peeling bottle 11, which is produced by blow molding from a laminated parison and composed of the inner layer and the outer layer, a plug body 12, which is fixed on a mouth portion 11a of the bottle 11, and a protection cap 13. It is formed in a manner whereby when a user detaches the cap 13, makes the laminated bottle 11 resupinate, and squeezes the body portion 11b by pushing, eye drops (fluids) are dropped from a point nozzle part 15 through a discharging pass inside of the plug body 12.

Said laminated bottle 11 has a laminated structure composed of an outer layer bottle 1 (squeezing bottle) which composes the outer layer and an inner

layer bag 16 (fluids storing bag) which composes the inner layer. In the aftermath of blow molding, both the outer layer bottle 1 and the inner layer bag 16 have a cylindrical mouth portion and a flat body portion from the cross sectional view. The outer layer bottle 1 may be molded from a PET (viz., polyethylene terephthalate), and PC (viz. polycarbonate) or like synthetic resin. Additionally, the mouth portion of the bag 16 forms an opening for discharging liquid.

As shown in Fig. 3 to Fig. 5, the outer bottle 1 is formed in a manner wherein a cylindrical mouth portion 4 is provided at an upper end of a body portion 2, which is resiliently squeezable and formed in a cylindrical shape with a bottom, through a shoulder portion 3 whose diameter is getting smaller as it goes upwards. A peripheral wall of the body portion 2 is constituted in a shape of a long flat circle, in which the before-and-behind width is smaller than the right-and-left width of the body portion 2, from a pair of before and behind rigid wall parts 5 facing each other having a specified distance and right and left flexible connecting wall parts 6, which connect either side of edge parts of these rigid wall parts 5. Each rigid wall part 5 (before-and-behind wall parts) has a rectangular shape of which the long side is in an up and down direction in a front view, and almost flat in a cross-section in a vertical-section. However, it may be unnecessary to be perfectly flat and it may be slightly curved. Each flexible connecting wall part 6 (right-and-left wall parts) has an arc shape in which longitudinal center portion projects toward a right-and-left direction, and its curvature radius is smaller than the minor axis of the body portion 2. Additionally, an upper end portion of each rigid wall part 5 is connected to the shoulder portion 3 through an upper flexible connecting part 7, and a lower end of each rigid wall part 5 is connected to a bottom portion 2a of the body 2 through a lower flexible connecting part 8. Therefore, a periphery of each

rigid wall part 5 is surrounded only by said flexible parts 6, 7, and 8. Also before and behind rigid wall parts 5, the bottom portion 2a, and the shoulder portion 3 are connected integrally only by flexible parts 6, 7, and 8.

The upper flexible connecting part 7 and the lower flexible connecting part 8 are located more outwardly than the rigid wall part 5 in the direction of before and behind. Therefore, when the bottle 1 is blow-molded from said plastic parison, the elongation rate of the plastic becomes larger and each connecting part 7 and 8 is formed relatively thin-walled, so that the easily deformable flexibility is applied to these connecting parts 7 and 8. While the rigid wall part 5 is formed thick-walled, so that the difficult-to-deform rigidity is applied to the wall part 5. It is preferable to compose average wall thickness of these connecting parts 7 and 8 to be thinner than half of the average wall thickness of the rigid wall part 5.

Also, horizontal width of the body 2 of the squeeze bottle 1 is 1.5 times larger than the longitudinal width (i.e. the distance between the outside surface of the before and behind rigid wall parts 5), at the time of the blow molding. Also the elongation rate of the plastic at the portion which forms right and left flexible connecting wall parts 6, so that the average wall thickness of right and left flexible connecting wall parts 6 is thinner than the average wall thickness of the rigid wall part 5. Further, at the stage of the parison for blow molding, it is possible to make the thickness of the portion which forms the rigid wall part 5 thicker than the thickness of the portion which forms the flexible connecting part.

Since the outer layer bottle 1 is composed in the aforementioned manner, when the before and behind rigid wall parts 5 are made close to each other till the distance between the center portion of the top-to-bottom direction of the before and behind rigid wall parts 5 becomes half by pressing the center portion

with two fingers, the right and left connecting parts 6 and the upper and lower connecting parts 7 and 8 are deformed in their elastic region in a manner wherein the upper and lower edges of the rigid wall part 5 move following the said center.

In addition, an entry opening 17 for leading ambient air to the room between the body portion of the bottle 2 and a body 16a of the inner layer bag 16 is bored at the center portion of the both top-to-bottom and right-to-left direction of the front side of the rigid wall part 5 (front wall part) of the outer layer bottle 1 of this embodiment. This entry opening 17 is formed from the opening going through the outer layer bottle 1 from the inside to the outside, and not bored on the inner layer bag 16. Additionally, a circular formed concave part 18 whose diameter is larger than the one of the entry opening 17 is formed on the center portion of the both top-to-bottom and right-to-left of the rigid wall part 5. This concave part 18 is formed in a manner wherein it is caved in the bottle, and the diameter of which is approximately 5mm. Aforementioned entry opening 17 is formed in the concave part 18. The entry opening 17 may be blocked by blocking the concave part 18 with a finger. The entry opening 17 doesn't have a check valve and constantly remains open, and the dimensions of this opening are approximately between $1mm^2$ and $2mm^2$.

Also an examination opening 19 which communicates with the entry opening 17 through the room between the outer layer bottle 1 and the inner layer bag 16 is bored on a midway portion of the top-to-bottom direction of a mouth portion 4. In the present embodiment, two examination openings 19 are formed at the points facing in the direction of the diameter. This examination opening 19 is also going through the outer layer bottle 1 from the inside to the outside, and not bored on the inner layer bag 16. This examination opening 19 is blocked up with a mouth 16a of the inner layer bag 16 from inside, so that air between

the outer and inner layer 1 and 16 is prevented from going out from the examination opening 19 during use of the eyedropper 10. To ensure this blocking by the inner layer bag 16, in the present embodiment, the mouth 16a of the inner layer bag 16 is pressed to the examination opening 19 by the after-mentioned inside plug 21. Thus, the examination opening 19 is blocked up with the inner layer bag 16 and the inside plug 21.

The average thickness of the mouth 16a of the inner layer bag 16 is approximately 0.5mm.

Also, the body 16b of the inner layer bag 16, depending on the plastic materials used, may have approximately 0.35 to 0.4mm average thickness, and it easily shrinks as the liquid inside decreases, however it also has an elastic-memory toward the direction of expanding. This elastic-memory of the body 16b of the inner layer bag 16 is set out in a manner wherein the difference between the pressure in the inner layer bag 16 and the ambient pressure is to be between 40hPa and 60hPa. Also the elastic-memory of the body 16b is set out to be bigger than the filtration resistance of the after-mentioned filter. Also, the body 16b of the inner layer bag 16 has the elastic-memory wherein the body 16b is easily deformed under the pressure between 400hPa and 600hPa, which affects during the stage of the dropping by squeezing.

Additionally, the center of a bottom portion of the bag 16 is fixed to the center of the bottom portion of the outer layer bottle 1, so that the bottom portion of the bag 16 is prevented from being lifted.

Aforementioned plug body 12 mainly includes an inside plug 21 fitted in the bottle mouth portion 4 and a nozzle cap 22 axially connected to the inside plug 21 and fitted around the bottle mouth portion 4.

The inside plug 21 is such that a first cylindrical portion 21a with its proximal end abutting against a distal end surface of the bottle mouth portion 4,

a flange 21c which is placed inwardly in the direction of the diameter on the abutting point of said first cylindrical portion 21a and the bottle mouth portion 4, and a second cylindrical portion which extends from inside of this flange 21c to upstream side, are integrally molded. The second cylindrical portion 21b is fitted in the bottle mouth portion 4 air tightly and fluid tightly. Particularly in the present embodiment, the second cylindrical portion 21b extends toward lower (upstream side) than the examination opening 19, and aforementioned examination opening 19 is closed air tightly from inside with this second cylindrical portion 21b.

The nozzle cap 22 is a generally cylindrical member, which includes a top plate provided with the nozzle portion 15 at its axially distal end, and they are integrally molded. The first cylindrical portion 21a of the inside plug 21 is fitted in the inner peripheral wall of the nozzle cap 22. The nozzle cap 22 has a smaller diameter cylindrical portion provided in a distal outer peripheral portion thereof with a step. The protection cap 13 is threadingly fitted around the smaller diameter cylindrical portion.

A filter 25 is provided in a lower surface of the top plate of the nozzle cap 22. This filter 25 comprises a filtration film 25a and an inner liquid holding member 25b provided in the primary side (upstream side) of the filter 25. Examples of the filter 25 include a hydrophilic porous planar film, a membrane filter, a sintered filter and a hydrophobic porous planar film, all of which are capable of preventing passage of pathogenic bacteria from a downstream side (outside) to an upstream side (inside). As this filtration film 25a, like such whose average diameter of the bore is between 0.1μm and 0.3μm are preferably adopted. More preferably, as the filtration film 25a, "Millipore Express Plus membrane filter" manufactured by Millipore Co. is adopted. This Millipore Express is like such of which the diameters of pores of the primary side and the

second side are different. The average diameter of pores around a surface of the second side is approximately 0.22μm and the diameter of pores becomes larger as it goes to the primary side. As just described, by using the filter wherein the diameter of pores around the surface of the second side is as small as just to be able to filtrate bacteria and becomes larger as it goes to the primary side, it is able to both keep the aseptic condition of the inner layer and make filtering resistance of the filtrations film smaller. The inner liquid holding member 25b is made in a discotic shape from a silicone pad or the like and the microscopic pores (the diameter of which is from 10m to 0.1mm) on it are able to hold the liquid inside. Additionally, a rim of this inner liquid holding member 25b may or may not abut on the end of the first cylindrical portion 21a of the inside plug 21. Also, it is not necessary to use said inner liquid holding member 25b, in the case wherein the inner liquid holding member is not used, it is preferable to provide a backup member (backstay member) to a back side of the filtration film 25a to prevent the filtration film 25a from being damaged.

The filtration resistance of the filter 25 is preferably approximately between 10hPa and 50hPa and designed to be smaller than the difference between a negative pressure in the inner room, which is caused by the elastic-memory of the body 16a of the inner layer bag 16 and the ambient pressure. This design is available by, in concrete, molding multiples of laminated film-peeling bottles which differ from each other in their inner layer body thickness, carrying out the examination, and selecting the most preferable thickness which is agreeable to the shape and size of the plastic and the bottle used. Also, the filter 25 (in the present embodiment, the whole of the filtration film and inner liquid holding member) is provided in a manner wherein the pressure for vacuuming the air from the lower side is between 689hPa and 4826hPa, and the resistance is higher than the difference between the inner pressure of the inner bag 16 caused

by the elastic memory of the body 16b of the inner bag 16, and the ambient air pressure. Additionally, the difference between the inner pressure of the inner bag 16, caused by the elastic memory of the inner layer, is smaller than the one at the bubble point of the filter 25 (and the filtration film 25a).

In addition, a communicating channel 22a which communicates with the nozzle part 15 is provided on the lower surface of the top plate of the nozzle cap 22. The liquid inside flowing from the filter 22 is provided to the nozzle part 15 through the communicating channel 22a. This communicating channel 22a comprises a first channel which radiates outwardly from the nozzle part 15 in the basal plane view, and multiples of circular second channels whose center is the nozzle part 15.

To discharge liquid inside from the nozzle part 15 in the case using said eyedropper 10, the user makes the laminated bottle 11 resupinate, and squeezes the body portion 2 of the outer layer bottle 1 by pushing in a manner wherein the entry opening 17 is closed by a finger, so that the air between the inner and outer layer 1 and 16 is supercharged and the inner layer bag 16 is compressed. In this manner, by generating inner pressure in the inner layer bag 16, the liquid inside is dropped from the nozzle 15 through the filter 25. After stopping pressing the bottle 11, leaving the finger from the entry opening 17 lets in the ambient air between the inner and outer layer 1 and 16 thorough the entry opening 17. After that, the liquid staying inside of a pass in the nozzle (i.e. a discharging pass point opening) is vacuumed to the upper stream side of the filter 25 caused by the elastic-memory of the inner layer bag 16. In addition, the liquid inside is sheltered from the ambient air by the filter 25. In this case, if the filtration film 25a of the filter 25 is composed of a hydrophilic filter, it is possible to prevent the ambient air from entering into the inner layer since the ambient air cannot pass through the filter 25.

The present invention is never limited to the conformations shown in the illustrated embodiment, but may be modified in any appropriate manner or fashion, within the realm of the technical ideas included in the claims.

The present invention is preferably used as an aseptic eyedropper.